Space Weather Forecast

Issued on Friday, 14 July 2023 at 13:20 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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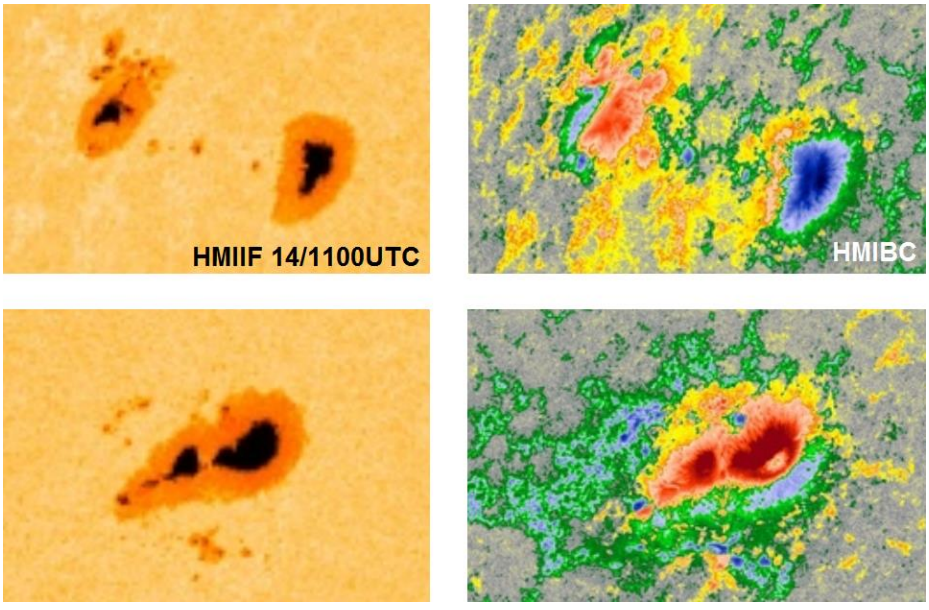
Space Weather Forecast Headline: Minor/Moderate R1/R2 Blackouts Likely throughout. Peak Chance of G1/G2 Minor/Moderate Geomagnetic Storms in next 24 hours.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been moderate over the past 24 hours, with X-ray flares showing isolated Moderate-class activity, firstly at 13/1920UTC from a large northeastern sunspot group, and secondly in the southwest at 14/0936UTC from a second complex region. The second event appears to have produced a CME, which may yet bear an Earth-directed component but has yet to be analysed. This pattern of activity was not unexpected given that these two sunspot regions account for much of the complexity on the Earth-facing side of the Sun.

Figure 1: Visible and magnetic polarity imagery of the two largest sunspots on the facing side of the Sun, as at 1100UTC. Both spots cover roughly a thousandth of the facing side of the Sun – very approximately each is ten times the size of Earth.



There are up to nine sunspot regions on the facing side of the Sun at the time of writing, with two new regions becoming visible in the far east, as a third became difficult to discern in the far northwest. By far the largest and most complex are those responsible for the flares, however.

The Sun has been relatively prolific in producing Coronal Mass Ejections (CMEs) in the period, however most appear to variously arise from western solar horizon prominences; high solar

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latitudes and perhaps a large region pointing directly away from Earth. None of these recent CMEs have been identified as carrying an Earth-directed component, however confidence in this assertion is lowered given their sheer number and cross-pollution in analysis.

Solar Wind / Geomagnetic Activity: The solar wind showed a mostly small magnitude but disturbed trace. The causes of the unsettled behaviour are not definitive, but may be a combination of a weak 10 July CME arrival and developing minor fast wind.

The solar wind speed was within background levels throughout, but did show a discontinuity upwards at 13/1530UTC, remaining nearer this level for the rest of the period. The number of particles comprising the wind rose to a concurrent peak before falling back. The associated magnetic field also peaked at a similar time at slightly elevated levels, before moderating over the remainder of the 24 hours. The north-south component showed a range of being mainly co-aligned with Earth's field at first to drift more anti-aligned with time, eventually resuming more typical background behaviour from around 14/0530UTC.

Because of the sudden onset, this was perhaps a CME, with later solar wind measures then perhaps indicating a segue into the commencement of a minor coronal hole fast wind.

The net result of the above solar wind measures was provisionally mostly quiet geomagnetic activity.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is likely, with the daily risk of isolated Moderate-class flares roughly partitioned equally between the two largest and most complex regions on the Sun. These remain on the front-side throughout.

Solar Wind / Geomagnetic Activity: The geomagnetic forecast is relatively low confidence, however it remains the case that activity should peak during the first half of the four-day forecast, with the 11 July CME glancing and perhaps combining with a weak fast wind. Any possible tenuous successor coronal hole fast wind is highly uncertain but not likely to be significant.

There is a chance of Minor/Moderate geomagnetic storms G1/G2 on day one, Friday 14 July, falling to a mainly quiet forecast from Sunday 16 July.

Energetic Particles / Solar Radiation: No solar radiation storms are expected, with a daily slight chance of reaching the S1/Minor Storm threshold through the period, should any appropriate larger X-ray flares occur.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	40	10	1	1
Strong	G3	No	5	5	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	60	60	60	60
Very Active	R3 to R5 X	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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